of sinking through watery strata, (6, 7, and 8) methods of supporting excavations and the construction of dams, (9, 10, and 11) methods of working, and (12) pumps and ore dressing. The illustrations have been selected with great care from standard authorities, due acknowledgment of the source being made in each case. The only fault that can be found with the diagrams is, that the authors have covered so wide a field that it has been necessary in some cases for them to crowd together into one diagram too many drawings. The best of the series are the remarkably bold and effective diagrams illustrating methods of working. The least satisfactory are the perspective views of machinery and of timbering. Plans and sections would have been better.

In Northern Spain. By Hans Gadow, M.A., Ph.D., F.R.S. Pp. xvi + 421. With map and eighty-nine illustrations. (London: Adam and Charles Black, 1897.)

THE incidents and impressions of two prolonged journeys through the northern and north-western provinces of Spain are brightly recorded in the volume before us. Personal experiences always have in them the making of an interesting book; and when things are seen with an intellectual eye, and the itinerary refers to places off the beaten track, the narrative is sure to engage attention. The present work, in which the wanderings of Dr. Gadow and his wife are described, possesses both these claims to recognition; moreover, it is well illustrated by camera and pencil. The accounts of the districts traversed, and the notes on the characteristics and customs of the inhabitants, will interest geographers; while archæologists will find a chapter on the Dolmen of Álava, and numerous short descriptions of other interesting antiquities. For students of biological science there are chapters on the fauna and flora of Northern Spain. The former chapter is a valuable analysis of the fauna of the Iberian peninsula.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Highest Kite Ascent.

THE general interest in scientific kite-flying leads me to send the following account of a flight here on September 19, when meteorological records were brought down from the greatest height which it is believed a kite has yet attained. The experiment was part of an investigation into the meteorological conditions of the free air now in progress here, and which is aided by a grant from the Hodgkins Fund of the Smithsonian Institution.

A Richard baro-thermo-hygro-graph (described in *La Nature*, 8 Février, 1896), weighing but 3 lbs., was hung 130 feet below two large Hargrave kites, and other kites were attached at intervals to the four miles of steel wire forming the flying-line, the total sustaining surface of the seven Hargrave kites used being something over 200 square feet. At their highest position the two topmost kites were 9386 feet above Blue Hill, or 10,016 feet above sea-level. The altitudes, at short intervals of time, were obtained from angular measurements with a theodolite, and were confirmed by the barometer record of the meteorograph.

This instrument left the ground about noon, and the greatest height was reached soon after four o'clock, the meteorograph remaining more than a mile above the hill during five hours. A little more than two hours were required for the steam-winch to reel in the four miles of wire, and the meteorograph returned to the ground at 6.40 p.m. The wind on the hill blew from the south with a velocity of about twenty-five miles an hour, but veered to the west in the upper air. The chief results, obtained from the automatic records, which are smooth and distinct, are these:—The temperature at the highest point was 38°, while at the ground at the same time it was 63°, giving a decrease of 1° per 375 feet rise, which is less than normal. The relative humidity at the ground was about 60 per cent. of saturation, but rose rapidly with height to about 4000 feet, which is the level of the cumulus clouds. It then fell, but rose again to nearly saturation above 7000 feet, when approaching the level of the alto-cumulus clouds. The humidity fell to less than 20 per cent. at the highest point reached. Throughout the flight the sky was clear. A. LAWRENCE ROTCH.

Blue Hill Meteorological Observatory, September 23.

Outlying Clusters of the Perseïds.

THE clearness of the sky, and the absence of the moon's light at the end of July and in the beginning of August last, were unusually favourable conditions here for watching the progress of the August meteor-shower of Perseïds from the first signs of its appearance up to very near its date of greatest brightness. Having intended to observe the shower in connection with a watch arranged by Mr. Denning to be kept on the Perseïds this year at many places, and an early beginning of the watch having been recommended, in order to note the progressive changes of the radiant-point's position, I had little expectation of being able to contribute much to this inquiry from the usual scarcity of the Perseïd meteors in the shower's early stages.

A theory of its progressive motion had been formed and compared with observations by the late Dr. Kleiber, of St. Petersburg (*Monthly Notices of the Royal Astronomical Society*, vol. lii. 1891–92, p. 341), depending for its application on certain effects and laws of planetary perturbations. Starting from the same, or from a very similar principle of the effects of planetary disturbances on meteor-orbits with that used by Prof. Adams to calculate the motion of the node of the November meteor-system, that without change of shape or of inclination to the plane of the ecliptic, of the long elliptic orbits round the sun, the line of nodes or intersection of the orbit-plane with the ecliptic is carried secularly backwards or forwards slowly round the ecliptic-circle, according as the motion of the meteors in the orbit is direct or retrograde, Dr. Kleiber showed that the meteors' apparent radiant-point on the earth's encountering the stream, would also be carried with the orbit round the pole of the ecliptic at the same rate in longitude, and without any changes in its apparent latitude. If the earth should thus at any point encounter meteors of the shower which have undergone less or greater secular displacements of their nodes than the main meteor-body, so as to furnish slender meteor-streams observable a few days before or after the principal shower-date, since the earth advances round its orbit through nearly one degree of longitude each day, the differences in longitude between these slender streams' and the main stream's radiant-points will evidently be as many degrees, or very nearly as many degrees as the earth takes days to traverse the distances between the outlying meteor-systems and the main one. Tested by this criterion, Dr. Kleiber showed that of forty-nine apparent foci of the Perseïds observed by Mr. Denning, in various years, between July 8 and August 16, forty-six were reducible by applying to all their longitudes the corrections corresponding according to the theory with their dates, to within a circle of only 2° radius round a point at 43°·6, +57°·1 assigned by Dr. Kleiber as the cometary radiant-point. This surprisingly close agreement certainly afforded a convincing proof of the adequacy of the perturbation theory to explain the recorded changes of position of the Perseïd meteors' radiant-point; but I had been rather sceptical of obtaining from such scanty materials for observations as the very early traces of the Perseïd comet meteors seem to offer, positions of sufficient accuracy to be capable of furnishing with much reliability such a very satisfactory agreement? In a watch of three hours, however, on the exceedingly fine night of July 22 last, seven Perseïds were recorded here, of which two (like two on the 18th and 20th), were directed nearly from the usual shower-centre at about 43°, +57°, but the other five diverged so distinctly from about 23°, +49° near υ and ϕ, at the point, instead of from near χ and η at the handle of the sword of Perseus, that the displacement of the radiant-point at this early date from its usual position to one in, at least, considerably lower right-ascension and declination, was at once very evident, and I was induced to longer watches, on later nights, by this first indication, than I would have thought likely, otherwise to be very usefully productive.

The following short Table (I.) gives a summary of the

TABLE I.—*Observations of Perseïd and Non-Perseïd Meteors in July and August*, 1897.

Dates of the Watches	State of the Sky	Moon's Phase, and Brightness	Hours of Watches; and their Equivalent Durations in a clear dark sky			Numbers of Meteors seen						
			Hours		Lengths (about)	From the Perseïd Radiants					Total Numbers of Perseïds	Numbers of Sporadic Meteors
			From	To		φ I	4 II	χ III	η IV	B, C Camelopardi V		
1897			h m.	h. m.	h.							
July 16	Clear	Gibbous; and bright	10 50	11 50	¾	—	—	—	—	—	—	1
,, 18	Rather hazy	,,	11 15	13 0	1¼	—	—	—	1	—	1	—
,, 20	Very clear	Third qr.; faint	12 0	13 0	¾	—	—	—	—	1	1	3
,, 22	,,	,,	10 30	14 0	3	4	1	—	2	—	7	15
,, 23	Slight cloud	Last crescent; faint	12 50	14 0	¾	—	—	—	—	—	—	3
,, 25	,,	,,	11 0 13 30	11 30 14 0	¾	1	—	—	—	—	1	1
,, 26	Cloudy for 1h.	Faint	11 15	13 45	1½	1	—	—	—	2	3	9
,, 27	Cloudy for 15m.	None	11 15	12 15	¾	3	—	—	—	—	3	8
,, 28	Clear	,,	11 10	12 0	¾	—	—	—	—	—	—	2
,, 30	Very clear	,,	10 20	14 0	3½	—	4	2	1	1	8	12
,, 31	Extremely clear	,,	11 15	13 30	2¼	—	2	—	—	1	3	15
August 1	,,	,,	10 30 11 45	11 30 13 0	2¼	2	—	—	2	—	4	18
,, 2	,,	,,	10 10	14 15	4	1	10	6	1	2	20	14 (one = 3 × ♀.)
,, 3	,,	,,	12 15	14 15	2	1	3	—	2	1	7	12
,, 4	,,	,,	10 45 13 5	11 45 14 35	2½	2	1	2	1	1	7	16
,, 6	Clear	None	11 30	12 30	1	—	—	2	—	4	6	—
,, 8	Cloudy	First qr.; faint	9 5	9 20	¼	—	—	—	1(?)	—	1(?)	1(?), = ♀
,, 8	Clear	None	11 30 13 20	11 45 14 40	1½	3	1	4	3	3	14	11
,, 9	Very clear	Gibbous; weak, till 13h.	9 30 11 0	10 30 14 55	¾ 3¼	2	1	1	14	10	28 (one = ♀.)	26 (one = 4 × ♀.)
Total Length of clear Watch; and Numbers of Meteors seen					33½	20	23	17	27	26	113	167

watches kept until August 9, the five radiant-points of the Perseïds which seemed to be certainly determined being noted as I.-V. in the Table, and being also graphically represented in the accompanying Figure (1), of the 113 or 114 tracks of Perseïds which were noted. In another Table (II.) the hourly numbers are shown of the meteors of these Perseïd showers on the nights of their greatest frequencies, and of sporadic meteors seen on the same nights, using only dark clear hours of the watches from near midnight onwards, to derive the numbers.

TABLE II.

Meteor Showers	Approximate Positions of the Radiants. in		in		Hourly Numbers (near and after midnight), of the Perseïd and Sporadic Meteors seen on Maximum Dates:—						
					1897, July			1897, August			
	R.A.	Decl.	Long.	Lat.	22	27	30	2	6	8	9
From the Perseïd Radiants I	23°	+49°	42°	+36°	2	4*	—	—	—	2	—
II	27	+53½	47	+38	—	—	2	4	—	—	—
III	36	+55	54	+37	—	—	1	2	2*	3	—
IV	42	+56	58	+37	< 1	—	—	—	—	2	4
V	51	+57½	64	+37	—	—	—	< 1	4*	2	3
All the Perseïd Meteors ...	—	—	—	—	2–3	4*	3	7	6*	9	8
Sporadic Meteors	—	—	—	—	4–5	5–6*	2–3	3–4	—	7	8

* In short Watches of 1h. only.

The small fireball seen on August 9, at 14h. 18m., lit up the ground with a slight, but sensible illumination, and left a bright streak from 353°, + 5° to 350°, + 1°, which remained visible for three-quarters of a minute. It was not a true Perseïd, but if it was identical with a bright meteor seen at the same hour at Exeter by Mr. Besley, its radiant-point appears to have been near κ and β Persei, at 45°, + 45°. The Venus-like Perseïd which fell at 14h. 43m. on the same night from 88°, + 37° to 98°, + 26°, near Venus, in the East, also left a very dense bright streak, visible for 15 seconds; its apparent course here was straight from η Persei. The equally bright meteor seen in a break between clouds on the previous evening, from 261°, + 26° to 255°, + 10°, at 9h. 10m. (± 3m.), was also true in direction from η Persei, and might be identical with a meteor of the same appearance seen at 9h. 10m. by Mr. Norman Lattey at Cardiff (*English Mechanic*, vol. lxvi. p. 15, August 20, 1897), if it had left a streak, and had not seemed to move rather more slowly overhead than the swift-flighted Perseïds. The height of its path above the earth would be from 135 to 115 miles if the two meteors really were identical! A more ordinary height of from 81 to 47 miles, was found by Mr. Denning from a second observation of it at Bridgwater, by Mr. Corder, for the non-Perseïd fireball seen here at 13h. 57m. on August 2. This meteor lit up the sky brightly with two concluding flashes, and left a greenish light-streak on the latter portion of its course, visible for 6 seconds. Its radiant-point was found by Mr. Denning, from the double observation, to have been between Aquarius and Aquila, at 312°, ± 0°, on the equator.

Although the watch was not maintained steadily on all fine nights, nor very often for many hours together on the single nights, yet some good views of further frequencies of the Perseïds, with definite centres of radiation, were obtained after the first display from υ, ϕ Persei on July 22, and were pretty successfully recorded. The latter centre remained active until July 27 (when it was again conspicuous), and then ceased, giving place to a second centre between ϕ and χ, near 4 Persei, at about 27°, + 53°; although a few Perseïd meteors still now and then appeared to come from the earlier radiant-point position in some later watches.

The second centre was first well marked on July 30, but it was most active on the beautifully clear night of August 2, with very well-defined radiation from about 30°, + 54°, and with another well-defined and nearly as productive centre near it at 35°, + 56°, whose meteors were afterwards grouped with others (chiefly on August 8) into shower III., at 36°, + 55°. On the two equally fine nights of July 31 and August 1, although sporadic meteors were most plentiful, yet three and four Perseïds only were noted, in watches of 2¼ hours, against 12 Perseïds in the time of watch between the same hours on the later night; and of the twenty Perseïds mapped in 4 hours then, 10 and 6, respectively, proceeded very accurately from the above two companion radiant-points! Like the first shower from ϕ Persei, the immediately succeeding one at 4 Persei ended in its turn on August 3, and produced only three meteors afterwards on later dates!

Clouds prevented observations on August 5 and 7, but an hour's watch on August 6 showed that the usual stream of Perseïds from the well-known radiant-point in Perseus was approaching, as four of the six Perseïds recorded then, diverged very distinctly from close round B, C Camelopardi.

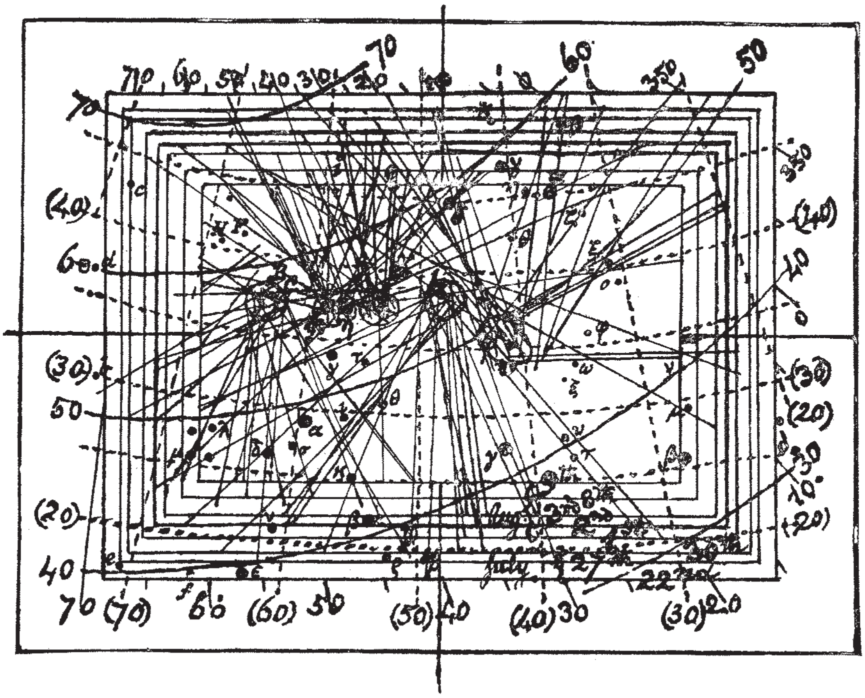


FIG. 1.—Path-lines of Perseïd Meteors belonging to Radiants I. (υ, ϕ); II. (4); III. (χ); and IV. (η, k Persei); and V. (B, C Camelopardi); July 22–August 9, 1897.[1]

In watches of two, and of four or five hours' duration, until daybreak, on the nights of August 8 and 9, 42 Perseïd and 37 sporadic meteor tracks were mapped at only the very moderate rates, for so near the epochal date, of eight or nine Perseïds per hour in the closing moonless hours of the two nights' watches; the abundance of the Perseïds on the mornings of August 9 and 10, in fact hardly exceeding the rate very perceptibly (of 7 per hour), which had already been noted a week previously at a similar time of watch on the morning of August 3! On the night of August 10 itself, the clouded state of the sky in England, generally deprived observers here of a view of the shower's appearance on its chief annual date; but from a list of 92 meteor-tracks mapped with nearly cloudless sky in 5½ hours on that night, at Le Havre, in France, which I received from a Member of the Astronomical Society of France, M. Libert, who records appearances of shooting-stars and fireballs at that nearly adjacent continental town to English stations, with extreme care and diligence, sporadic meteors seemed still to be greatly outnumbering the Perseïds, as they did here less strongly on the morning of the 10th, in the proportion of nearly two to one, if even allowances most favourable to the Perseïds are always made in cases where indistinctness of mapping made the radiation doubtful. Substitutions of pointing-stars for the points of first appearance and disappearance, and the abnormal lengths of path thus often noted, which chiefly produced uncertainty in the attempt to assign the meteors their true radiant sources, also prevented any exact positions of the shower's chief centres of divergence on that night from being extracted from the importantly supplied particulars, otherwise, of M. Libert's very valuable and extensive list of path-descriptions.

In point of brightness, however, with seven first-magnitude meteors, and two equal to Sirius or Jupiter, and two compared to Venus, the 25–30 Perseïd shooting-stars described by M. Libert, outshone the 60–65 sporadic meteors, at Le Havre, with their ten of first magnitude and only one each as bright as Sirius and Venus, about as brilliantly as the 28 Perseïds noted here on August 9, with six first-magnitude meteors and one or two each as bright as Sirius and Venus, exceeded the abundance (*pro ratâ*, or doubling the actual numbers here) of bright meteors appearing among the 26 contemporaneously observed non-Perseïd shooting-stars, with three first-magnitude, one Sirius-like, and (possibly) one brighter meteor than Venus, which, however, so nearly came within the range of radiation of the Perseïds that it is also counted in the category above, as possibly a Perseïd fireball.

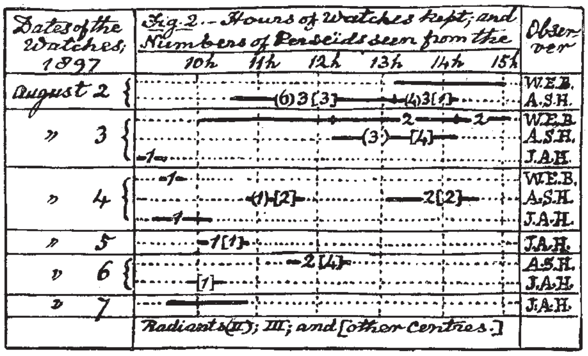
The shower had not yet subsided in numbers or in brightness, it appears, when the strength of the full moon's light had deterred me from looking out for it any longer, on the night of August 11; for in the hour and a half from 10h. 20m. to 11h. 50m. on that night, Mr. J. A. Hardcastle noted at Lymington, in Hants, the paths of ten Perseïds and five sporadic shooting-stars, with two of first magnitude among the former, but none so bright among the latter class of meteors; from which it would appear that the maximum of this year's weak display was probably impending still and not yet arrived at until after daybreak on August 11, when at 1h. 45m. a.m. on that morning, M. Libert ended his long watch of the shower on the night of August 10. With one stray flight from υ, φ Persei, six of the ten Perseïd meteors seen by Mr. Hardcastle diverged from η, *k* Persei, and three from B, C. Camelopardi. A bright streak-leaving Perseïd from the latter radiant-point was also noted, with seven non-Perseïd meteors in one hour, at Lymington, as late as the night of August 19.

---

[1] Circles of Longitude and Latitude are shown by dotted lines (and by figures for every 10°, enclosed in brackets); and circles of Declination by full lines. But to prevent their confusion with path-lines, and their obstructing the view of the path-lines' radiations, the close array of R.A. Meridian-lines is omitted, and the scale of right-ascension is only noted, like the Declination-circles, in plain figures for every 10°, round the border of the Map.

A long-continued watch was kept for 5½ hours at Exeter, on August 9, by Mr. W. E. Besley, and the paths of 108 meteors were recorded (*English Mechanic*, vol. lxvi. p. 16, August 20, 1897), among whose projections on a map, he states, a very distinct radiant-point of 71 Perseïds was shown at 43½°, + 57°; extremely near the place, at 43°·6, + 57°·1 assigned by Dr. Kleiber for the cometary main-stream of the shower. No evidences of a companion-stream at B, C Camelopardi seem to have been noticed among the Perseïd-paths by Mr. Besley; though it seems not impossible, in a case of such near contiguity of two co-operating meteor-streams, if only a few, or scattered tracks from the less productive stream, perhaps, were noted, that some real traces of the weaker and diffuser close-adjoining shower's existence, might easily be overpowered and hidden by the close-crowded group of path-lines round the principal shower's centre.

In a previous, almost equally extensive watch, however, kept on the nights of July 30, and August 2–4, at Westminster in London, of the results of which, in the *English Mechanic* (vol. lxv. p. 601, August 13, 1897), Mr. Besley also gave a most excellent condensed description, 47 meteors were noted at times almost simultaneous, on August 2 and 3 with my watches here; and together with three non-Perseïd radiant points in Triangulum and Andromeda, and near ζ Persei, a distinct radiant-point which Mr. Besley regarded as that of the "true Perseïds," was obtained from five meteor-paths, four on August 3, and one on August 4, at 32½°, + 57½°; only 2° from the place at 35°, + 56°, where on the night of August 2 the radiant-point III. first showed itself distinctly in my watches, accompanied by a closely adjoining and equally distinct and productive shower-centre (the shower II.) at 30°, + 54°. Although my watch and Mr. Besley's were partly contemporaneous on the night of August 2, when six and ten meteors respectively were noted here from the close pair of radiant-points III. and II., yet the five "true Perseïds" mapped by Mr. Besley were not seen among the 16 meteors whose paths he recorded on that night, but among the 27 noted on the following night and one on the night of August 4. These dates of our recorded maxima seem, however, to have been only apparently in disagreement, because, as the above diagram (Fig. 2) of the hours of watching shows, the rate of appearance of the "χ-Perseïds"[1] was at the most only three per hour, and in the times lost in noting observations, either shower might thus easily pass by unnoticed in a watch, for each of us in turn on those two nights, only barely extending to two hours.



In short watches on August 3, 4, and 5, at Lymington, three meteors proceeding from the "χ-Persei" position were mapped by Mr. J. A. Hardcastle, and a second Perseïd on the latter date from between υ and φ Persei. The first two path-lines' directions backwards, passing on either side of χ to a point of intersection at 33°, + 54° (about 3° south of χ), and that of the third within 1° east of or preceding χ Persei, through 32°, + 57°. One "φ-Perseïd" and four sporadic meteors were also mapped at Lymington in a short watch on August 6, and nine sporadic meteors, but no shooting-star from Perseus, on August 7!

There seems to be clear evidence in all these observations that pretty conspicuous appearances are observable in July and August, of well-marked brief *battues* of Perseïd shooting-stars, which follow each other in a regular order up to the chief annual display, from about three weeks before it; and additional observations of these feeble meteor-currents will be very useful to determine the exact durations, radiant-point positions and relative intensities as well as variations of intensities in future years, of these weak supplementary streams apparently derived by thinning out of the main current's ring-like, lengthened cluster, on the ring's preceding side.

In the Perseïd meteor-swarm's original progressive lengthening by dissimilar times of revolution and orbit-sizes among its individual meteors, until the slower- and faster-moving stream-ends overlapped each other along the orbit in several repeated circuits, the slightly different-sized orbits must be a little differently affected and impressed with node-line motions by planetary disturbing actions, and they must thus have gradually become very slightly separated from each other. But in the case of any local knot or condensation which the original meteor-cloud may have contained, from the very approximately equal revolution-times and orbit-sizes with which the meteorites in such a small cometary knot or parcel would all set out together from the scene of initial disturbance which first deflected the Tuttle's comet meteor-cluster of Perseïds into its present long-elliptic orbit, the densities and contracted limits of such small groups at intervals along the winding convolutions of the lengthy coil, would naturally still be retained, though less compactly, compared to poorer intervals between them; and weaker annual showers flanking the main one at some constant distances in time and longitude before or after it may thus be expected to be visible, like the present short series of them, or like the larger train of attendant Perseïd-showers which Mr. Denning has recorded, all verifying Dr. Kleiber's view of their origin so exactly by their radiant-point positions.

But the mean rate of motion in longitude of my few observed shower-centres, although also in very distinctly good and notable agreement with the theory, appears to have been a little over-rapid, or about 22° in eighteen days, instead of a little less than 1° *per diem*; and long-maintained activities of the grander central and of the laterally cast-off poorer meteor-streams seemed also in my watches to be as clearly evident and nearly as prominent a property of their radiations as the advance in longitude, both by often noted derivations of single and sparse meteors from them on very different dates from those of the showers' maximum abundances, and more especially by maxima of some of the showers having been noted simultaneously (as those of the showers II. and III. together on August 2, and of showers III., IV., and V. together on August 8 and 9), instead of, as the theory postulates, and as the showers I. and II. exemplified much more distinctly and it may quite possibly be shown hereafter by further better observations, more truly and correctly, with an interval of some few days between them in succession.

The mode of the figure's construction which shows the radiant-point directions of the 114 Perseïd paths recorded, requires a little explanation. As my view of the sky was chiefly overhead (embracing the north pole of the ecliptic the more readily to detect any changes in longitude of the radiant-point's position), the observed meteor-paths from Perseus nearly all shot upwards, and would confuse each other by cross-intersections if it were attempted to represent all the four or five radiant-points together by their means, on a single map. But as only depictions of the path-directions traced back to the several radiant-points, and not of the paths themselves were needed for the figure, these direction-lines only are represented in their true positions of passing near the several radiant-centres, but directed upwards and downwards alternately, for each radiant-point in turn, so as not very sensibly to confuse each other. The lines are also drawn of such lengths as to show by ending at different border-lines of the diagram, at what date, or approximate date (for the few Perseïds' paths noted on July 20, 23, 25-6, 28, and 31, and on August 4 and 6 are referred to the nearest special dates, by their line-lengths, only) in July or August any path-line was observed. In this way the progress of the radiation is either visible in its main outline at a glance, or any special peculiarities and features of it may be studied closely in detail.

---

[1] The star χ, and the conspicuous star-cluster in Perseus in which it appears to the naked eye to be involved, are situated at about 32½°, + 56¾°, within 1° of the place assigned by Mr. Besley to the Perseïd radiant-point on August 3–4, and only 2° or 3° from the places which were here obtained for Radiant III., at 35°, + 56°, on August 2, and 36°, + 55° for July 30–August 8. The star's name may thus be used conveniently, for shortness, as is done above and at a few former places in this *résumé*, to distinguish this radiant-point III. from the earlier Radiant II. near 4 Persei from July 30 to August 4, which seemed to precede it there quite distinctly and in good agreement with the theory, both in R.A. position and in time.

It may thus be noted easily that although not dying out for some days longer, the activity of shower I. was chiefly confined to the first week (up to July 27) of the watch; while the meteors of shower II., first appearing only on July 30, continued, with a maximum on August 2, to show themselves brightly up to August 3; and that little was to be seen of the main stream of η-Perseïds (shower IV.) until August 2-3, when it was still inconspicuous, but when a precursor limb of it, the intermediate shower III., was about as active beside shower II. as it again became afterwards on August 8, but more feebly on August 9, beside the plentiful displays then going on, of the showers IV. and V. from η Persei and B, C Camelopardi.

The offshoot as it seemed of the main shower's radiation, at the latter place, showed like the main stream itself, but slight signs of its existence, either in July or later, until August 6, when four of six meteors (all Perseïds), seen in an hour, diverged very distinctly from a point thus first well indicated near B, C Camelopardi. On the nights of August 8 and 9 it appeared to form an almost equally intense companion-shower to the η-Perseïds; and as it seems to conform well in its position to the straight onward line of motion of the other Perseïd centre-points, and to add apparently another link-step to the regular earlier stages of a chain-like progression, it might have been expected, had the nights of the 10th and 11th of August not been such unfavourable ones for noting any further changes in these loci of divergence, that with the expiration of the η-Perseïd shower IV., the accompanying stream V. from B, C Camelopardi, would perhaps survive it, or else would on some later night reappear with a new and naturally much weaker maximum agreeing with its theoretically proper apparition-date.

Some future years' clear skies, it may be hoped will allow the after-showers of Perseïds, already very clearly and distinctly traced by Mr. Denning, to be seen and noted in not less splendid weather than that which so well and continuously displayed the phases of the preceding showers' appearances in the present year.

Several exceptionally bright meteors, and some smaller ones presenting specially remarkable features of appearance, were noted in my watch, which, together with the real paths obtained from corresponding observations at other places of some of the shooting-stars and fireballs of its list, would furnish me with a sufficient abundance of interesting notes to fill another letter. But the subject of the latter meteors will be discussed more satisfactorily and completely in a general review of the collected observations which Mr. Denning and Mr. Corder are conducting; and satisfactory descriptions of the former meteors would involve more searches among known radiant-points, with full deductions of their radiant-centres for the 167 sporadic meteors of my list, than I have yet attempted, to summarise correctly the points of leading and rather novel interest which were presented by the radiations of some of the more particularly striking meteors. I must forego, therefore, a review of features of interest, and of real path conclusions which some of the individual meteors offered very attractively for description, although I felt at first much prompted to describe them; in order to place their discussion in the hands of those much better and more surely able than myself to judge of their importance, who in combination with Mr. Denning undertook the arduous task of collecting and the necessarily much slower and more dilatory task of abstracting and collating all these numerous descriptions.

A. S. HERSCHEL.

Observatory House, Slough, September 21.

A Colony of Highly Phosphorescent Earth-Worms.

IN the sheltered westward corner of a small grass-plat in this city there is a colony of highly phosphorescent earth-worms. The annelid is round, pellucid, slender, of a faint yellowish tint, is about two inches long, and is not flattened behind. I have been unable to distinguish segmentation. The worm is entirely luminous. The phosphorescence has precisely the bright greenish colour of the light emitted by the glow-worm. The light is under control. When in glow its secretion is luminous, as is seen in its trail and in the phosphorescence imparted to the hands when handled. It is said by the owner of the grass-plat that the casts are luminous. This is a point I have had no opportunity of observing.

At night the slightest irritation suffices for lighting-up. I captured one in a small clod of turf, to transplant in my grass-plat. The very slightest pressure of the clod, which I should have thought inappreciable, brought on a manifestation of light. On nights when not on the crawl and not otherwise visible, a favourite expedient is to stamp on the ground to get them to come to the surface. The worms in response at once rise to the surface and light up, as though it were possible for them to show fight, instead of, like other worms, scampering away.

The spot colonised is far from humid, but the worms are more active in wet than in dry weather. The worm is new to this place, and, as far as my researches go, it has not been observed westward in Wales. It seems to me to be an instance of *Lumbricus phosphoreus*, but it hardly agrees with the published description of that organism. I want to avoid depleting the colony, or putting any of the inmates to torture, but I could at least furnish a specimen.

J. LLOYD-BOZWARD.

Worcester, September 27

Appearance of a Noddy in Cheshire.

THE other day, when looking through a collection of stuffed birds, I saw and obtained a specimen of the Noddy Tern (*Sterna stolida*, Linn.). It is in immature plumage, the white on the crown being only just visible.

It was shot on the Dee marshes in winter about six years ago.

As I believe this Tern has been only twice recorded as visiting Europe, I think this specimen worth mention.

Neston, Cheshire, September 29. F. CONGREVE.

THE ETNA OBSERVATORY.

A RECENT number of *La Nature* (No. 1262) contains an interesting illustrated account of the observatory on Mount Etna, a building which was originally designed by Prof. Tacchini for some special investigations which he had in hand. The eruption which occurred in 1886 caused much disaster, and considerably affected the building which was not restored till the year 1891. In the observatory at the present time there is an equatorial of 5·5 metres focal length, besides various meteorological and seismographical instruments. Observations are made regularly, except in the winter months. This year a very important addition will be made by the setting up of telegraph and telephone wires as far as Nicolosi, thus rendering it possible to regulate the work.

The ascent from Catania, which town lies at a distance of about 30 kilometres in a southerly direction, is made by coach as far as Nicolosi (700 metres). One proceeds then by mule as far as Casa del Bosco (1440 m.), and to the Alpine meteorological station (1890 m.); this latter place being half-way between Nicolosi and the observatory. The rest of the way is made by foot over the snow; the path, which is very rough, can be ascended by mule in the summer, but it is impossible in the winter, owing to the great accumulation of snow. The observatory is sometimes buried in the snow to a depth of two to five metres, admission being then only possible through the first-floor windows.

The disadvantages of Mount Etna as an observing station are therefore due more to the snow than to volcanic disturbances. Long periods elapse between the volcanic outbreaks, during which time the surface near the central crater and the observatory is quiet, so that even the most sensitive seismograph may be used.